

# Colors and Animation

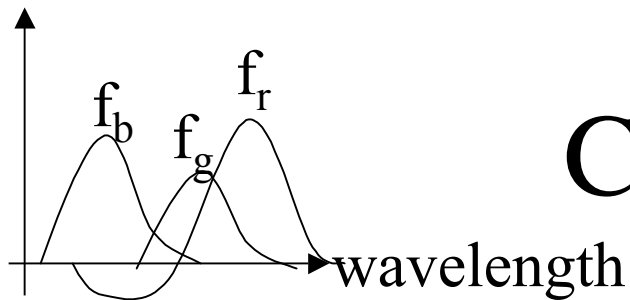
CS116B

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# Outline

- Color Models
- XYZ Color Model



# Color Models

- The behavior of color within some particular context is called a **color model**.
- Primary Colors.
  - When we combine light of different hues we can create new colors. This represents one way to make a color model.
  - Hues that we start with are called **primary colors**.
  - The colors we can form are called the **color gamut**
  - Two primary colors that combine together to make white are called **complementary**.
- No finite set of real primary color can be used to make an arbitrary color; however, three primaries suffice in practice to get most useful colors.
- Subtracting also plays a role in generating some colors, as can be seen with the so-called color matching functions for RGB in the diagram above.

# Artist Colors

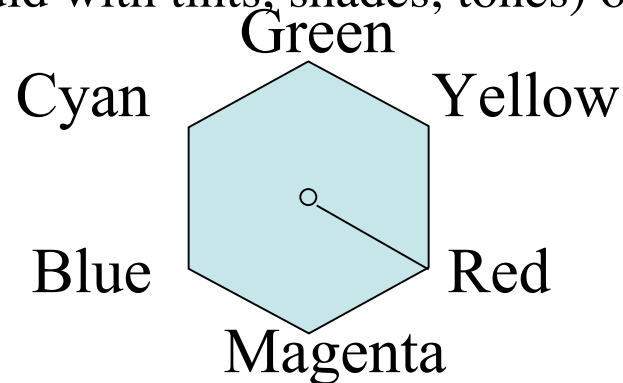
- Artists combine color pigments with white and black to form: shades , tints, and tones in a scene.
- Start color + black = a shade
- Start color + white = a tint
- Start color + white + black = tone

# RGB

- We now give some example common color models.
- The color we want is represented as a vector: (R, G, B) where the values for these three are between 0 and 1. Thus, we have a color cube.
- The wavelength of light this represents is  
**RR + GG + BB**  
where **R** has hue 630 nm, **G** has hue 530 nm and **B** has hue 450. Note the these are not necessarily pure colors. For instance, in the NTSC standard, the ratio of the energy density at the wavelength for red to the total energy density is .330 . This is the saturation.
- The point in choosing these wavelength is that the cones in our eyes, which are responsible for seeing color respond strongest to stimulation in these three colors.

# HSV

- This model is based on a more intuitive model (a model based on mixing colors as we did with tints, shades, tones) of color than RGB.



- We start with a color hexagon of pure colors. (Take the non-black, non-white, corners of RGB color cube, delete the edges involving black and white from cube to get above hexagon).
- Hue is measured as an angle, measure from red to the color around the hexagon.
- Saturation measures the purity of the color measure how far from the center of the hexagon we are. It goes from 0.0 to 1.0.
- We imagine a cone beneath this hexagon which represents brightness value 0 being no dark 1 being the maximum.

# Computer Animation

- In the remaining time, we will very briefly discuss some ideas concerning animation.
- There are two basic methods for constructing a motion sequence in computer graphics.
- Real-time -- used in games
- Frame by frame -- used in movies can use slower more computational expensive techniques.

# Raster Methods

- These techniques are useful in the real-time setting.
- **Double buffering** is a common such method. We have multiple buffers for holding the scene we are rendering.
- We display one frame and as we are displaying it we render into an offscreen buffer the next frame.
- Then we toggle which of the buffer is being displayed and start rendering the next frame again in the other buffer. If this is all happening on the video cards memory called **page-flipping**.



# More Raster methods: Palette Tricks.

- Can prerender several frames of an animation using a fixed color palette all on the same image.
- We select the colors so that only the frame we want showing is in distinct colors.
- The other frames have their palette colors set to the background color so they appear like the background.
- Then we change the palette to step through the animation making different frames visible.